



**FCC 47 CFR PART 15 SUBPART E
ISED RSS-247 ISSUE 2**

CERTIFICATION TEST REPORT

For

LED Projector

MODEL NUMBER: S2

FCC ID: MSQ-S2

IC: 3568A-S2

REPORT NUMBER: 4788623965.3-2

ISSUE DATE: September 5, 2018

Prepared for

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Website: www.ul.com**

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	09/05/2018	Initial Issue	



Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6dB/26dB Bandwidth	FCC 15.407 (a)&(e) RSS-247 Clause 6.2	PASS
2	99% Bandwidth	RSS-Gen Clause 6.6	PASS
3	Maximum Conducted Output Power	FCC 15.407 (a) RSS-247 Clause 6.2	PASS
4	Power Spectral Density	FCC 15.407 (a) RSS-247 Clause 6.2	PASS
5	Antenna Conducted Spurious Emission	FCC 15.407 (b) RSS-247 Clause 6.2	PASS
6	Radiated Bandedge and Spurious Emission	FCC 15.407 (a) FCC 15.209 FCC 15.205 RSS-247 Clause 6.2 RSS-GEN Clause 8.9	PASS
7	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	PASS
8	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	PASS
9	Frequency Stability	FCC 15.407 (g)	PASS
10	Dynamic Frequency Selection	FCC 15.407 (h) IC RSS-247 Clause 6.3	PASS



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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: ASUSTek Computer Inc.
Address: 4F,NO.150,Li-Te Rd. Peitou,Taipei Taiwan

Manufacturer Information

Company Name: ASUSTek Computer Inc.
Address: 4F,NO.150,Li-Te Rd. Peitou,Taipei Taiwan

EUT Description

Product Name LED Projector
Model Name S2
Series model S2E, S2C,S2M,S2Z
Model difference The schematic and structure of each model is same, the only difference is that the name of the model is different, but it will not affect the test result.
Date Tested August 16~ September 1, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	PASS
ISED RSS-247 Issue 2	Pass
ISED RSS-GEN Issue 5	Pass

Tested By:

Checked By:

Kebo Zhang
Engineer
Approved By:

Shawn Wen
Laboratory Leader

Stephen Guo
Laboratory Manager



2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 789033 D02 v02r01, RSS-GEN Issue 5, RSS-247 Issue 2, KDB414788 D01 Radiated Test Site v01, KDB 905462 D02 UNII DFS Compliance Procedures New Rules v02 and 905462 D03 Client Without DFS New Rules v01r02.

3. FACILITIES AND ACCREDITATIO

Accreditation Certificate	<p>A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA.</p> <p>IAS (Lab Code: TL-702) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has demonstrated compliance with ISO/IEC Standard 17025:2005, General requirements for the competence of testing and calibration laboratories</p> <p>FCC (FCC Designation No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules</p> <p>IC(Company No.: 21320) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p> <p>VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011</p>
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Note 1: All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China

Note 2: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OATS.



4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
	5.64dB (26GHz-40Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	



5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	LED Projector
Model Name	S2
Series model	S2E, S2C,S2M,S2Z
Model difference	The schematic and structure of each model is same, the only difference is that the name of the model is different, but it will not affect the test result.
Radio Technology	IEEE802.11a/n HT20/n HT40
Operation frequency	UNII-1/UNII-2A/UNII-2C/UNII-3
Modulation	OFDM(BPSK,QPSK,16QAM,64QAM)
Power Supply	AC120V/60Hz



5.2. CHANNEL LIST

20 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	36	5180
	40	5200
	44	5220
	48	5240
UNII-2A	52	5260
	56	5280
	60	5300
	64	5320
UNII-2C	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
UNII-3	149	5745
	153	5765
	157	5785
	161	5805
	165	5825



40 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	38	5190
	46	5230
UNII-2	54	5270
	62	5310
UNII-2C	102	5510
	110	5550
	118	5590
	126	5630
	134	5670
UNII-3	151	5755
	159	5795



5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
A	5150-5250	FPCB	3.4
	5250-5350	FPCB	3.4
	5470-5725	FPCB	2.2
	5725-5825	FPCB	2.2

Test Mode	Transmit and Receive Mode	Description
802.11a	1TX, 1RX	Antenna A can be can be used as transmitting/receiving antenna.
802.11n HT20	1TX, 1RX	Antenna A can be can be used as transmitting/receiving antenna.
802.11n HT40	1TX, 1RX	Antenna A can be can be used as transmitting/receiving antenna.

5.4. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature:	TL	0°C
	TN	23 ~ 28°C
	TH	40°C
Voltage :	VL	AC 102V/60Hz
	VN	AC 120V/60Hz
	VH	AC 138V/60Hz

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature



5.5. WORST-CASE CONFIGURATIONS

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate (Mbps)	Worst Case (Mbps)
a	OFDM	BPSK,QPSK,16QAM, 64QAM	54/48/36/24/18/12/9/6	6

802.11n HT20/HT40							
Antenna	MCS	Modulation	HT20 Data Rate(Mbps)		HT40 Data Rate(Mbps)		Worst Case (Mbps)
			GI=800ns	GI=400ns	GI=800ns	GI=400ns	
1x1	0	BPSK	6.5	7.2	13.5	15.0	MCS0
	1	QPSK	13.0	14.2	27.0	30.0	MCS0
	2	QPSK	19.5	21.7	40.5	45.0	MCS0
	3	16-QAM	26.0	28.9	54.0	60.0	MCS0
	4	16-QAM	39.0	43.3	81.0	90.0	MCS0
	5	64-QAM	52.0	57.8	108.0	120.0	MCS0
	6	64-QAM	58.5	65.0	121.5	135.0	MCS0
	7	64-QAM	65.0	72.2	135.0	150.0	MCS0

Note: This device can work in master mode, but only support 2.4G frequency band in master mode.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	Laptop	ThinkPad	T460S	SL10K24796 JS

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	N/A	N/A	0.5	N/A

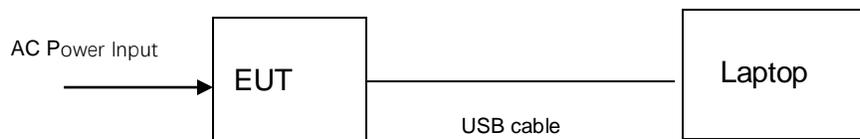
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	AC ADAPTER	ASUS	ADP-65GD D	Input: 100-240 Vac, 50/60 Hz, 1.5A Output: 19Vdc, 3.42A

TEST SETUP

The EUT can work in engineering mode with a software through a Laptop.

SETUP DIAGRAM FOR TESTS





5.7. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	101961	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	101983	Dec.12,2017	Dec.11,2018
Software						
Used	Description	Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance	UL	Antenna port	Ver. 7.2		
Radiated Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Jan.09, 2016	Jan.09, 2019
<input checked="" type="checkbox"/>	Preamplifier	HP	8447D	2944A09099	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	EMI Measurement Receiver	R&S	ESR26	101377	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
<input checked="" type="checkbox"/>	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 26, 2019
Software						
Used	Description	Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Radiated disturbance	Farad	EZ-EMC	Ver. UL-3A1		
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Power Meter	Keysight	N9031A	MY55416024	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Power Sensor	Keysight	N9323A	MY55440013	Dec.12,2017	Dec.11,2018
<input checked="" type="checkbox"/>	Power Sensor	Keysight	U2021XA	MY57030004	Dec.12,2017	Dec.11,2018



6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

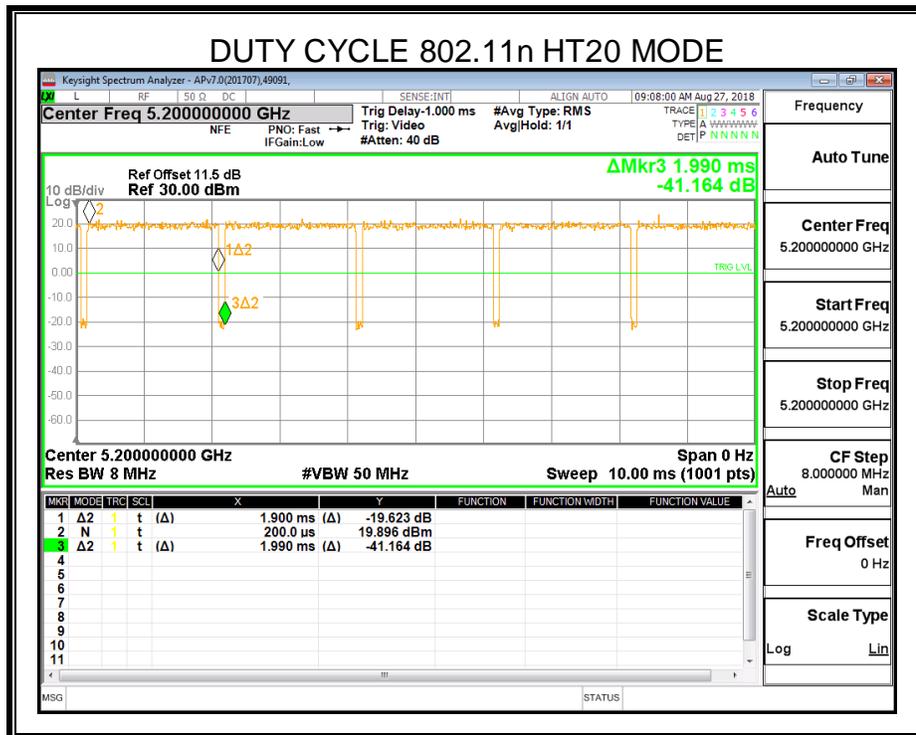
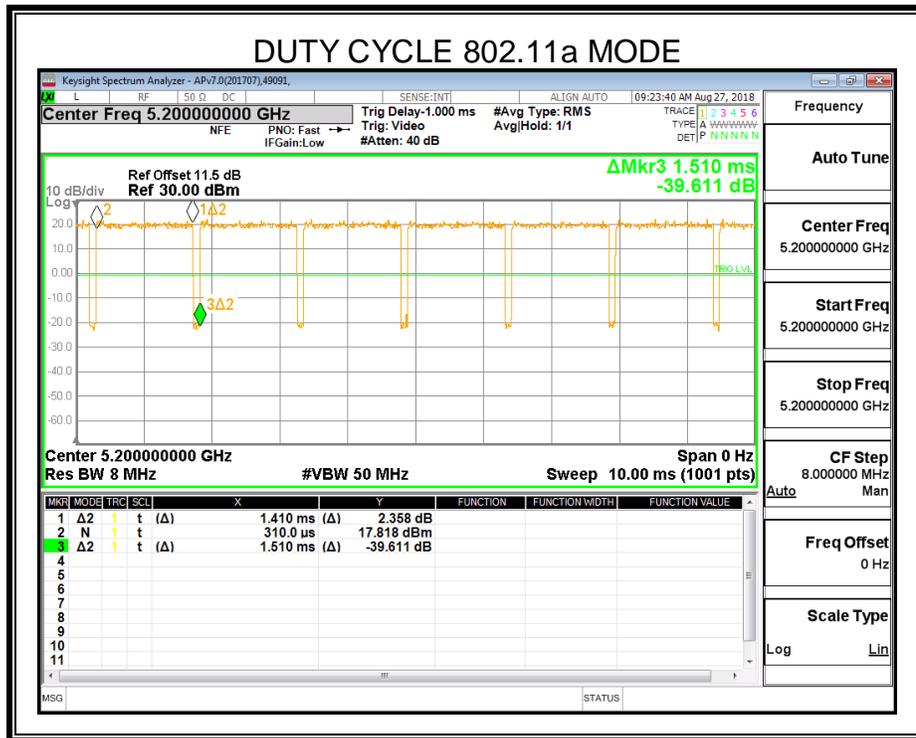
LIMITS

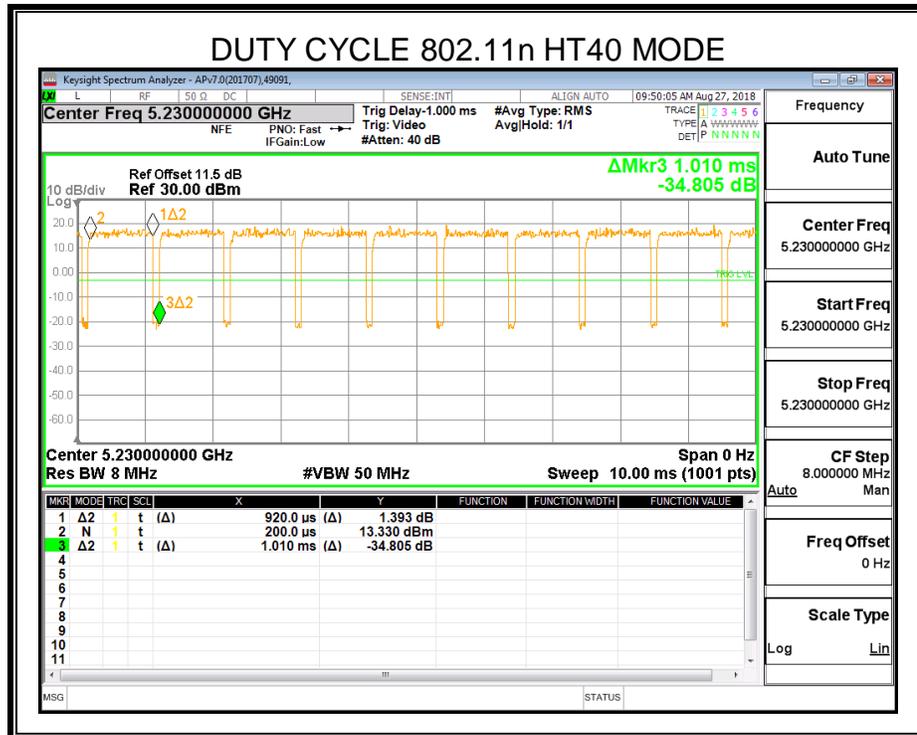
None; for reporting purposes only.

RESULTS

Mode	ON Time (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (KHz)
11a	1.410	1.510	0.9338	93.38%	0.30	1
11n HT20	1.900	1.990	0.9548	95.48%	0.20	1
11n HT40	0.920	1.010	0.9109	91.09%	0.41	2

Note: Duty Cycle Correction Factor= $10\log(1/x)$.
Where: x is Duty Cycle(Linear)





6.2. 6dB/26dB/99% dB BANDWIDTH

LIMITS

FCC Part15, Subpart E/ RSS-247		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	26 dB Bandwidth	5150-5250
	26 dB Bandwidth	5250-5350
	26 dB Bandwidth	For FCC:5470-5725 For IC:5470-5600 5650-5725
	Minimum 500kHz 6dB Bandwidth	5725-5850

RSS-247 ISSUE 2			
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.	2400-2483.5

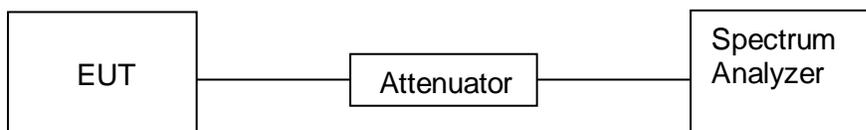
TEST PROCEDUREC

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth: RBW=100kHz For 26dB Bandwidth: approximately 1% of the emission bandwidth. For 99dB Bandwidth: approximately 1%~5% of the emission bandwidth.
VBW	For 6dB Bandwidth : VBW=300kHz For 26dB Bandwidth : >3RBW For 99%dB Bandwidth : >3RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6/26/99% dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



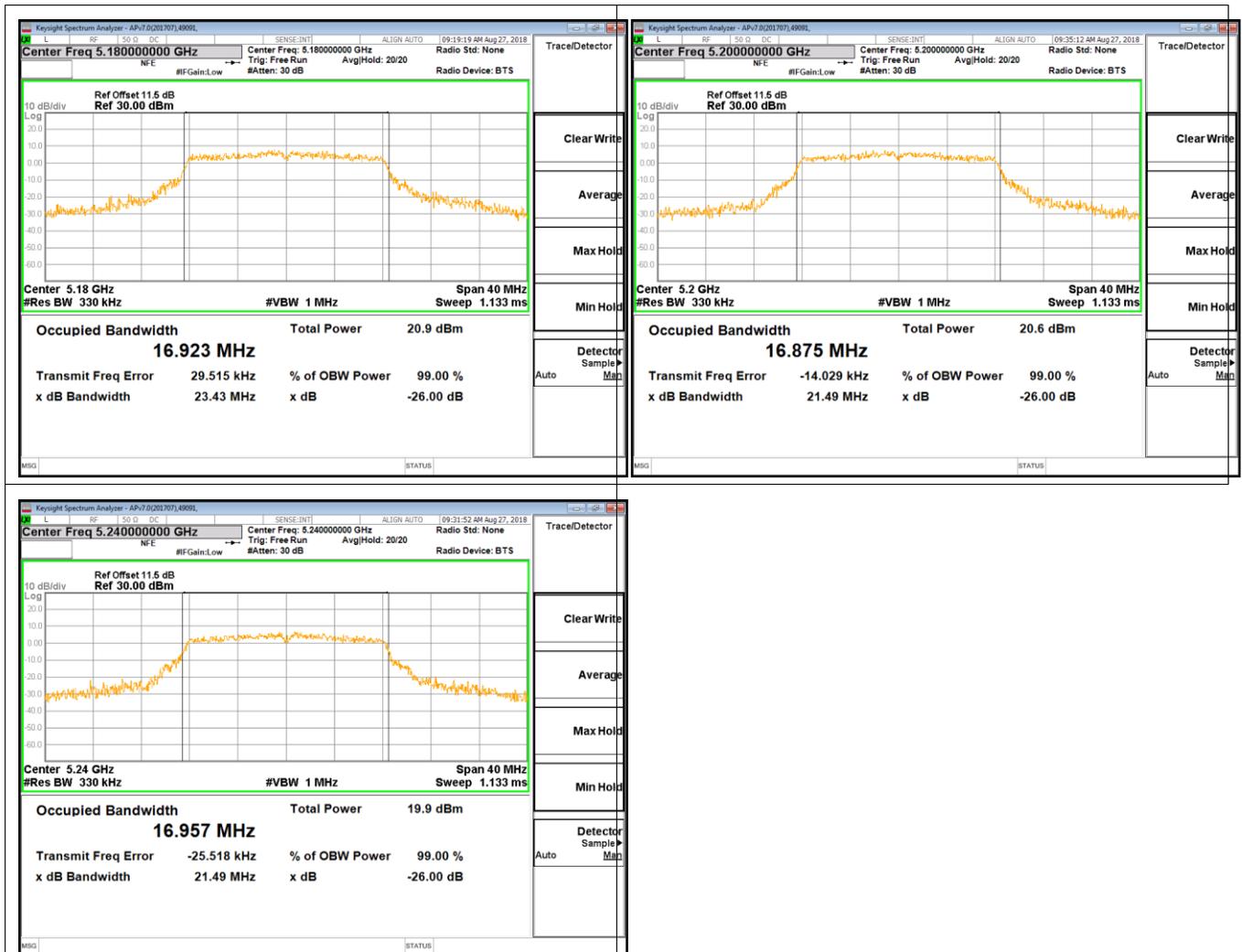
RESULTS



6.2.1. 802.11a MODE

6.2.1.1. UNII-1 BAND

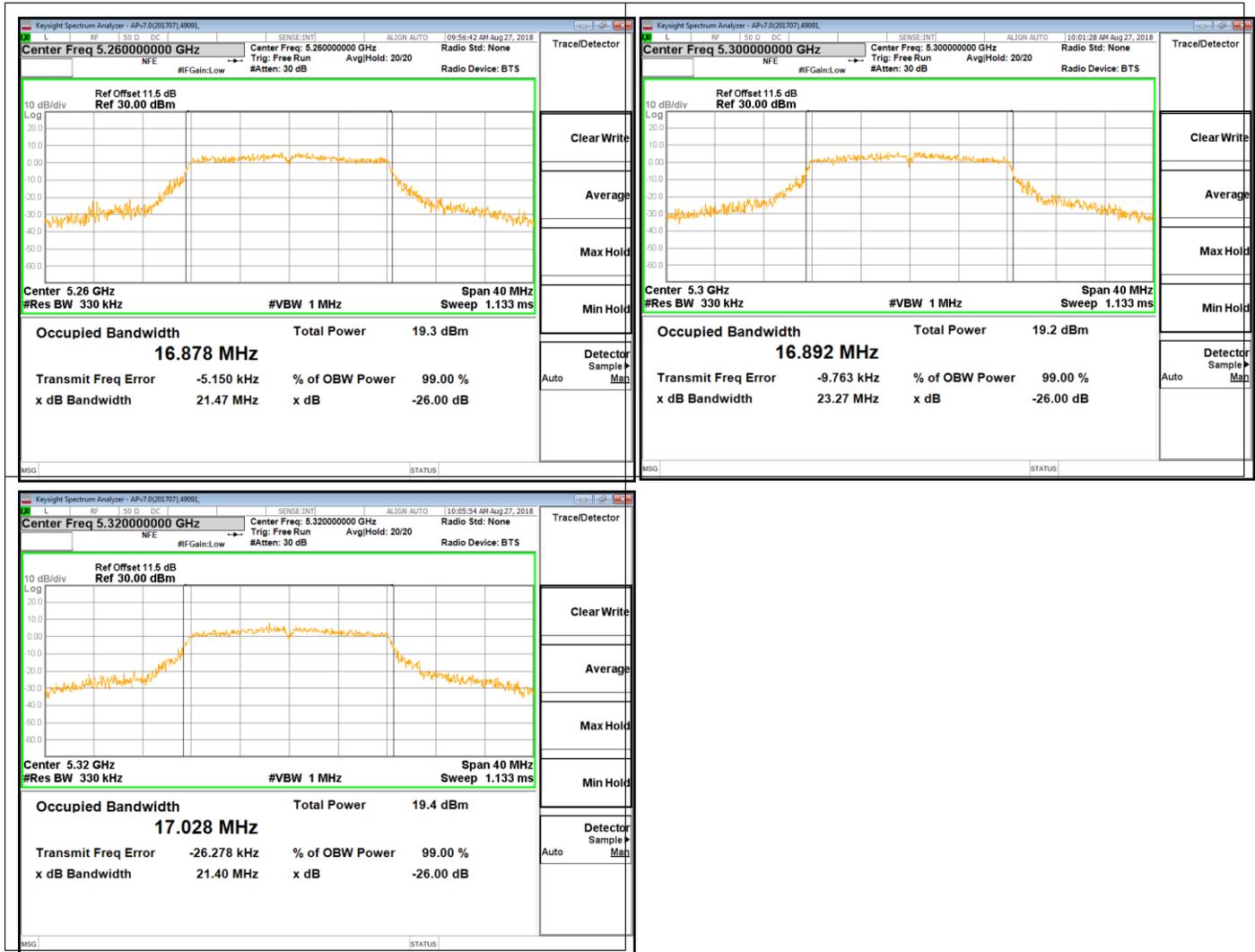
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5180	23.43	16.923
Mid	5200	21.49	16.875
High	5240	21.49	16.957





6.2.1.1. UNII-2A BAND

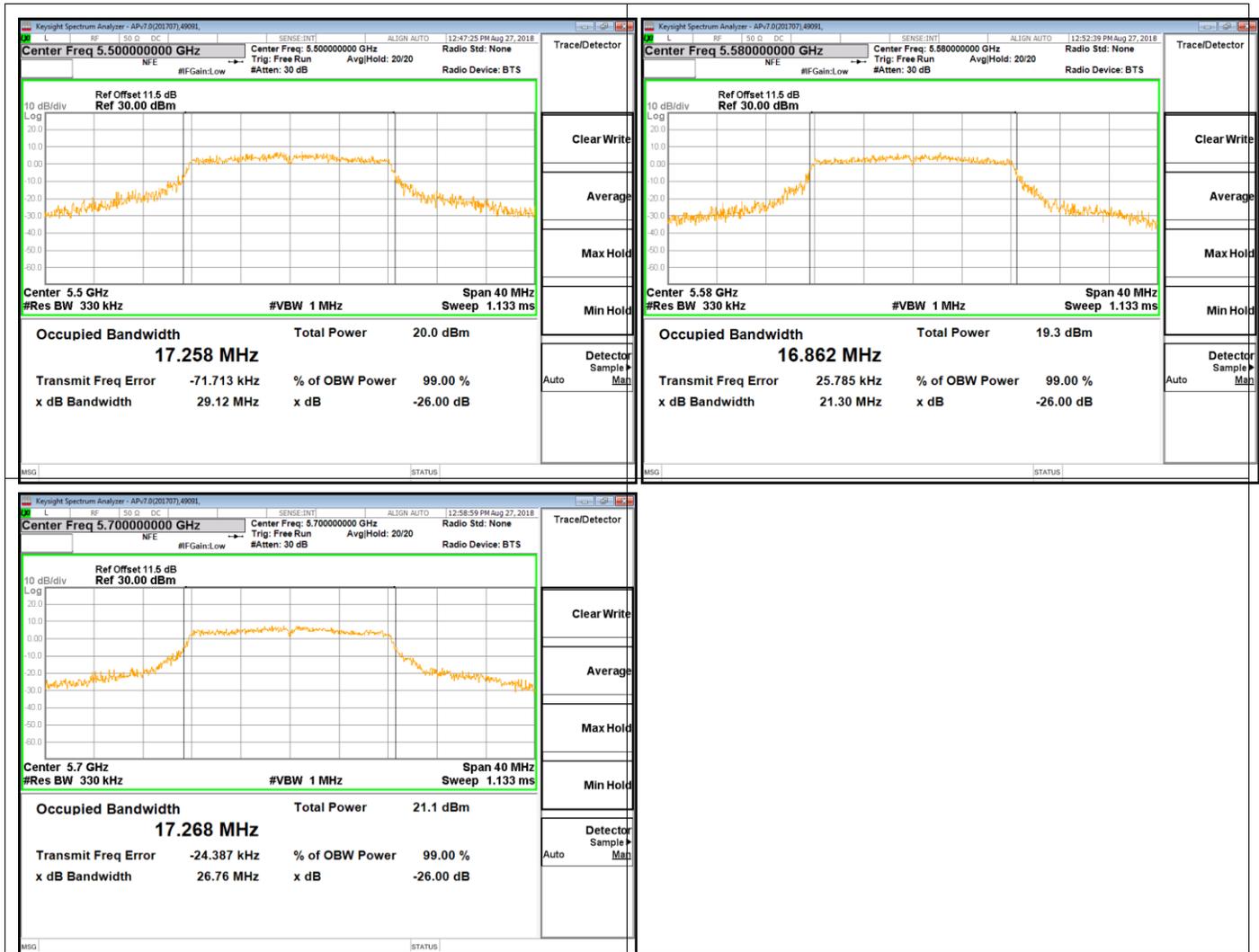
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5260	21.47	16.878
Mid	5300	23.27	16.892
High	5320	21.40	17.028





6.2.1.2. UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5500	29.12	17.258
Mid	5580	21.30	16.862
High	5700	26.76	17.268

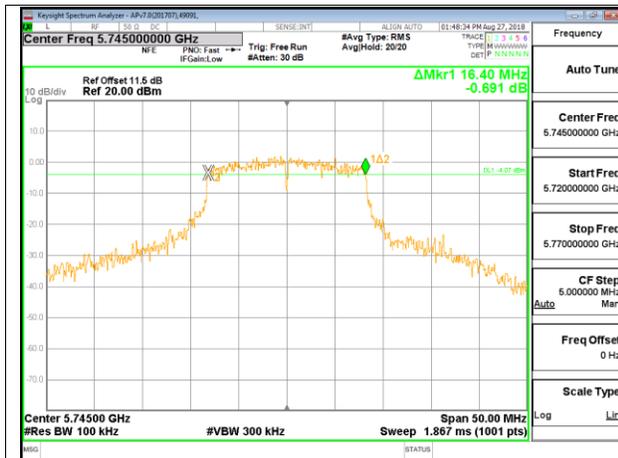




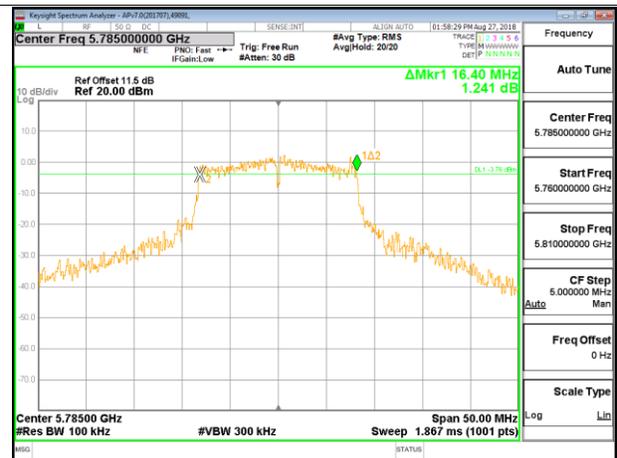
6.2.1.3. UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	Limit (KHz)	Result
Low	5745	16.40	500	PASS
Mid	5785	16.40	500	PASS
High	5825	16.40	500	PASS

Channel	Frequency (MHz)	99% BW (MHz)
Low	5745	17.127
Mid	5785	17.278
High	5825	17.254



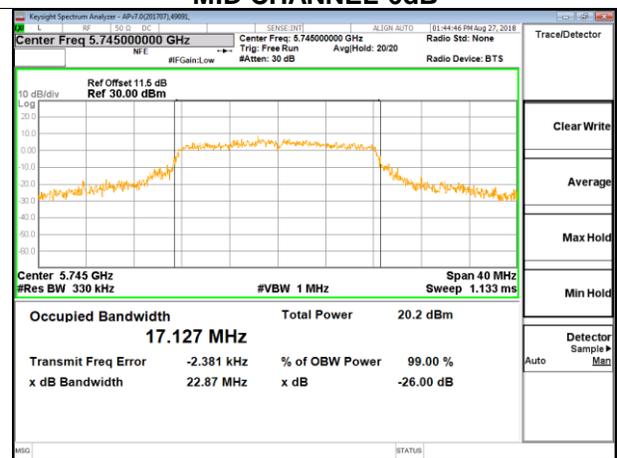
LOW CHANNEL-6dB



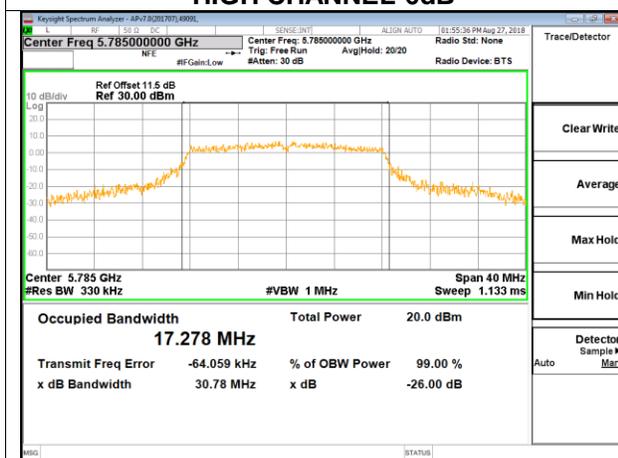
MID CHANNEL-6dB



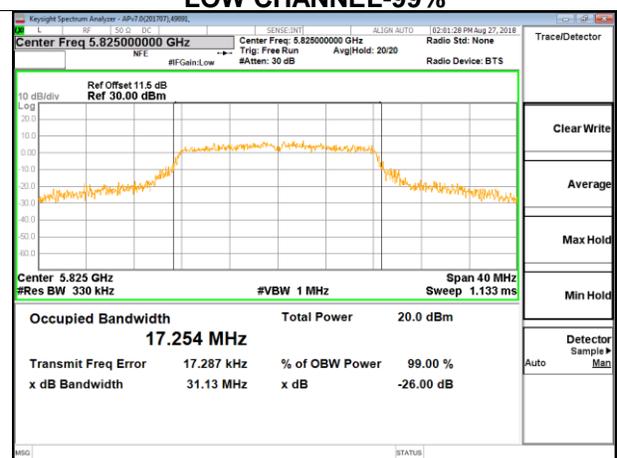
HIGH CHANNEL-6dB



LOW CHANNEL-99%



MID CHANNEL-99%



HIGH CHANNEL-99%



6.2.2. 802.11n HT20 MODE

6.2.2.1. UNII-1 BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5180	24.38	18.031
Mid	5200	27.11	17.994
High	5240	25.50	17.977

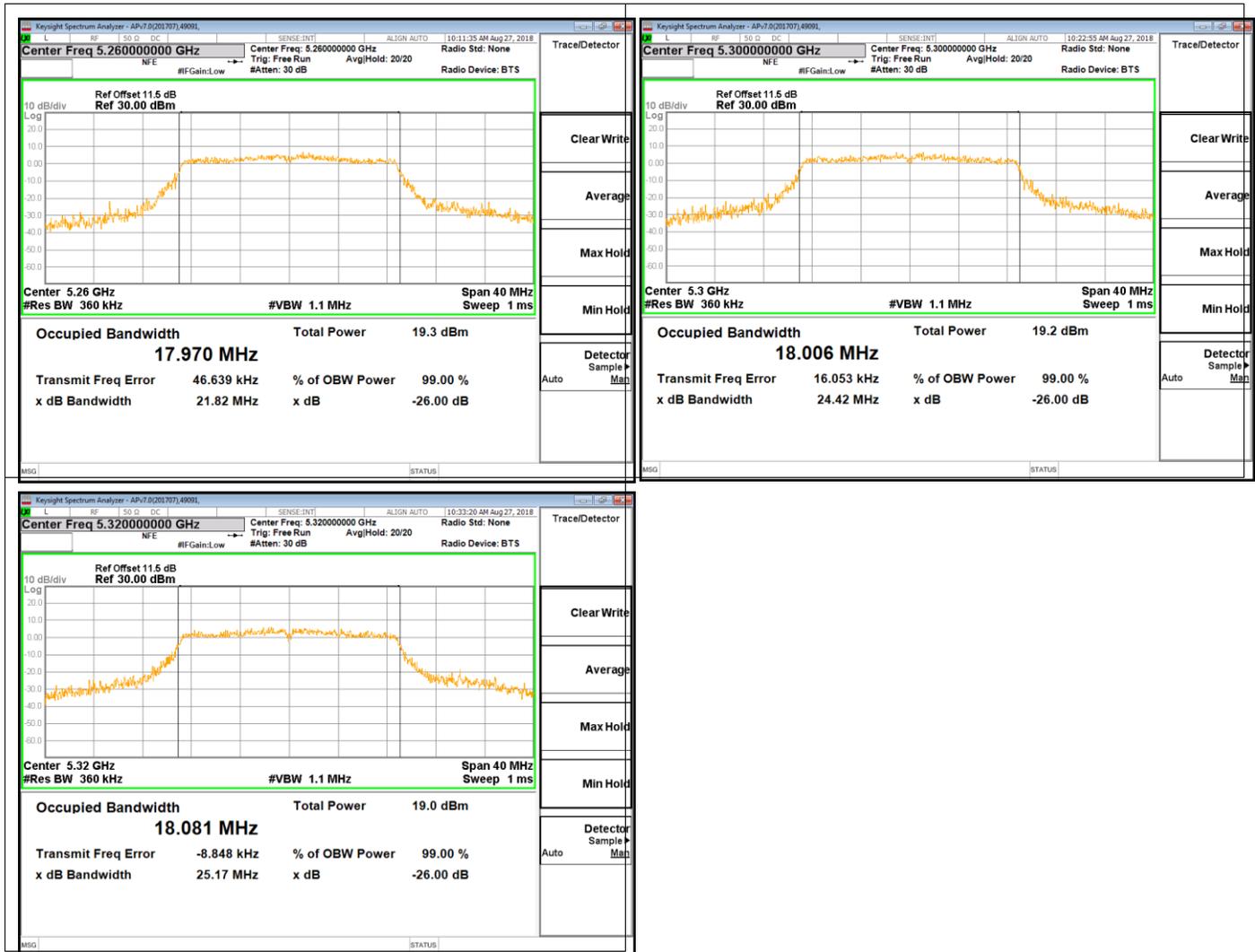


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6.2.2.2. UNII-2A BAND

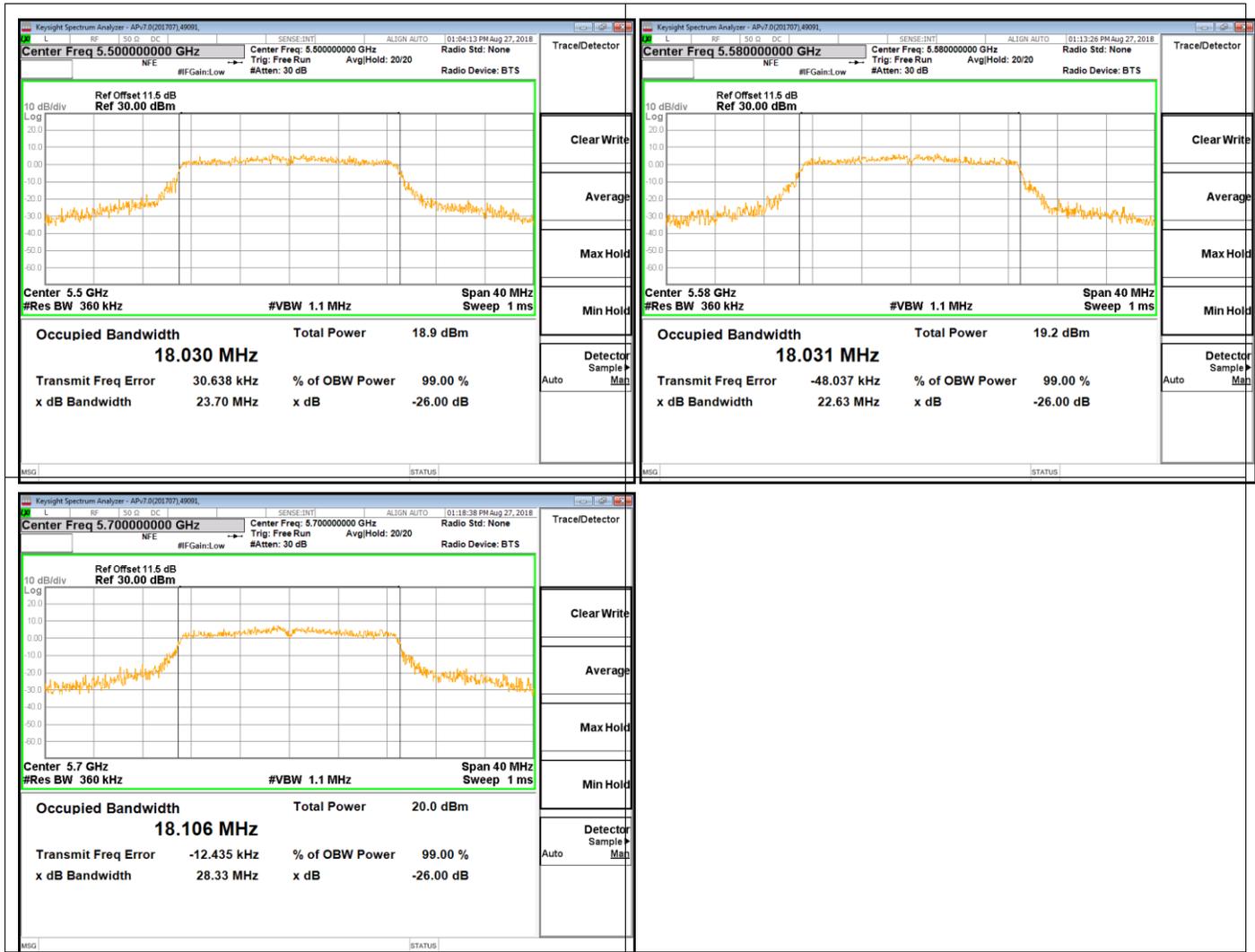
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5260	21.82	17.970
Mid	5300	24.42	18.006
High	5320	25.17	18.081





6.2.2.3. UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5500	23.70	18.030
Mid	5580	22.63	18.031
High	5700	28.33	18.106



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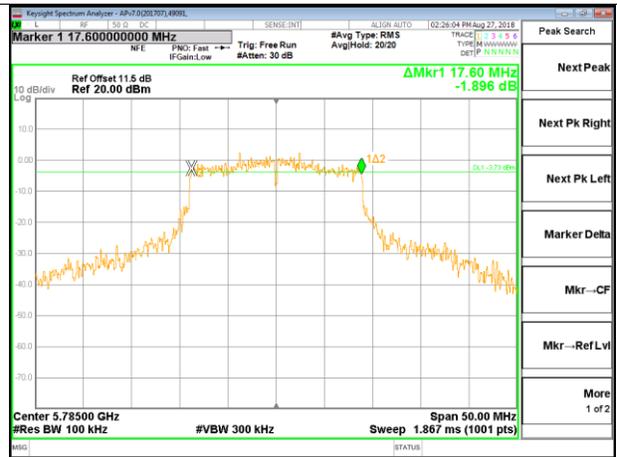
6.2.2.4. UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	Limit (KHz)	Result
Low	5745	17.70	500	PASS
Mid	5785	17.60	500	PASS
High	5825	16.80	500	PASS

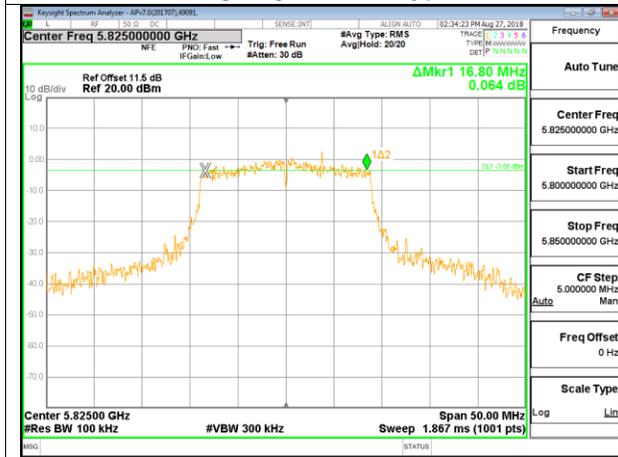
Channel	Frequency (MHz)	99% BW (MHz)
Low	5745	18.220
Mid	5785	18.158
High	5825	18.080



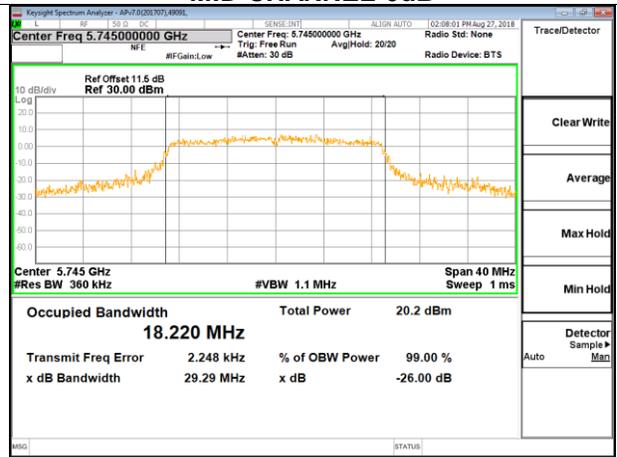
LOW CHANNEL-6dB



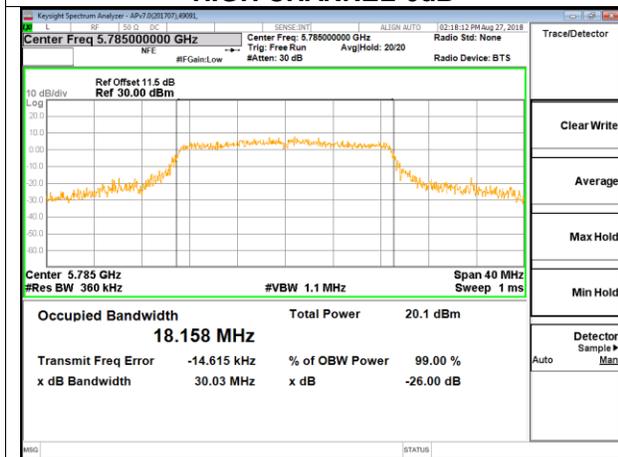
MID CHANNEL-6dB



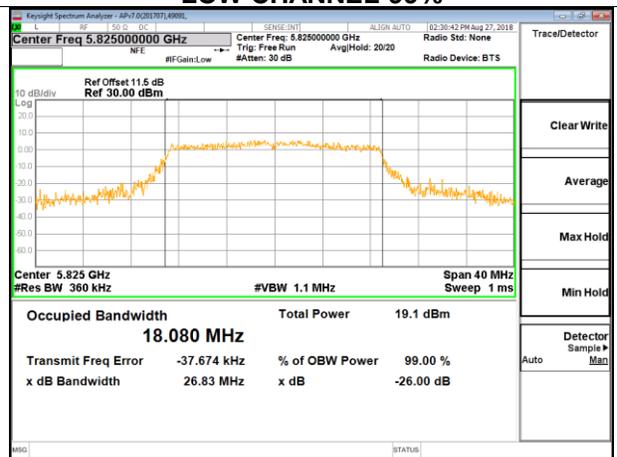
HIGH CHANNEL-6dB



LOW CHANNEL-99%



MID CHANNEL-99%



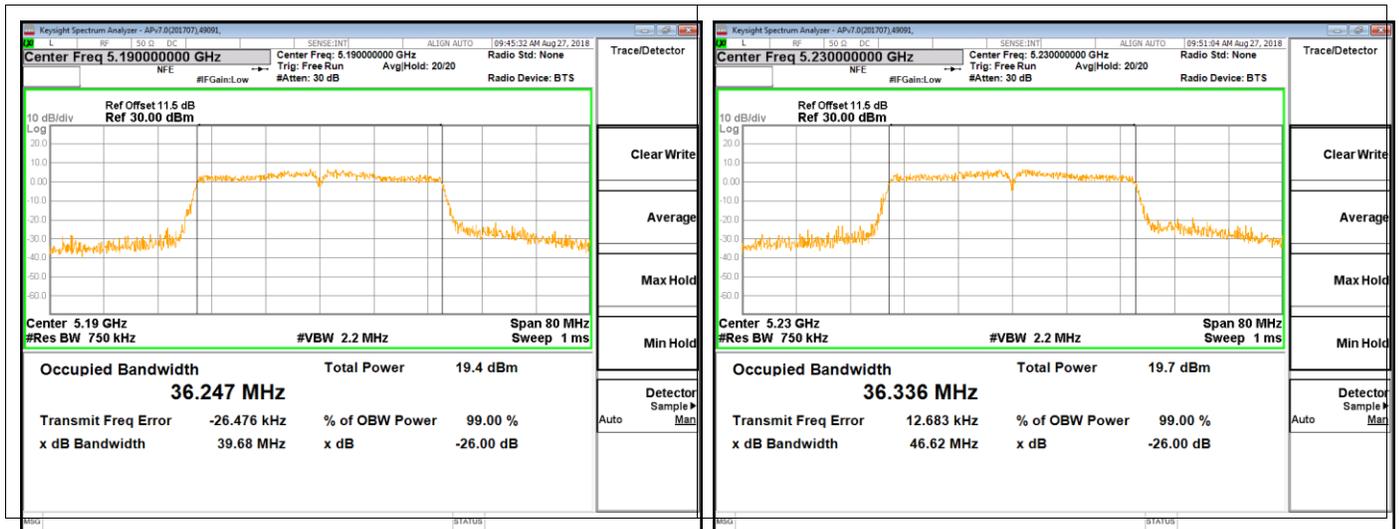
HIGH CHANNEL-99%



6.2.3. 802.11n HT40 MODE

6.2.3.1. UNII-1 BAND

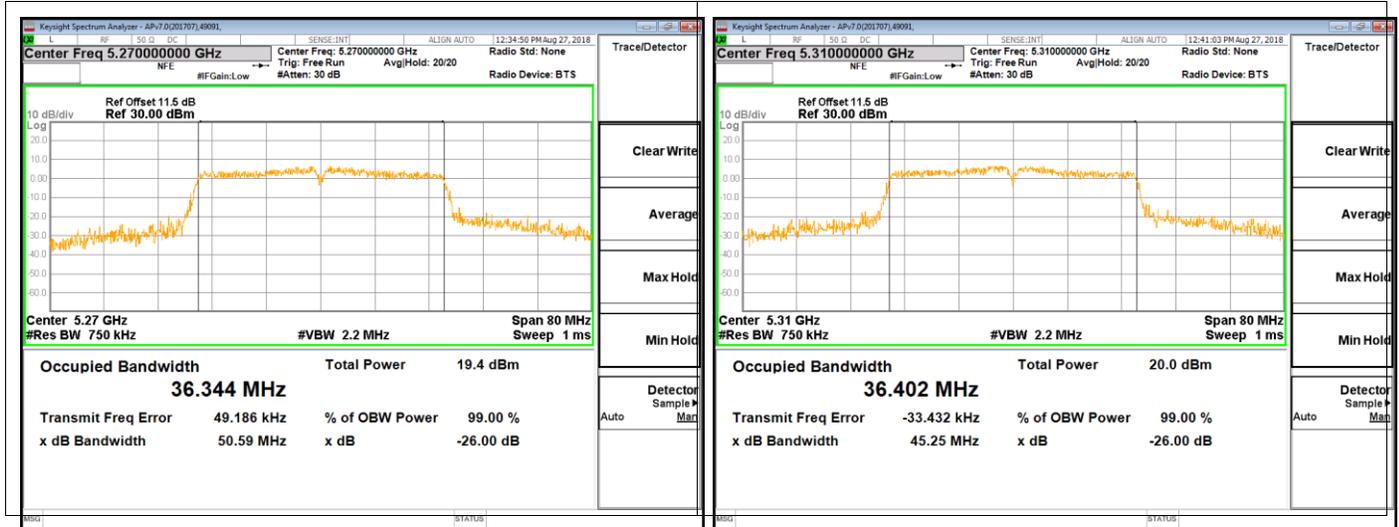
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5190	39.68	36.247
High	5230	46.62	36.336





6.2.3.2. UNII-2A BAND

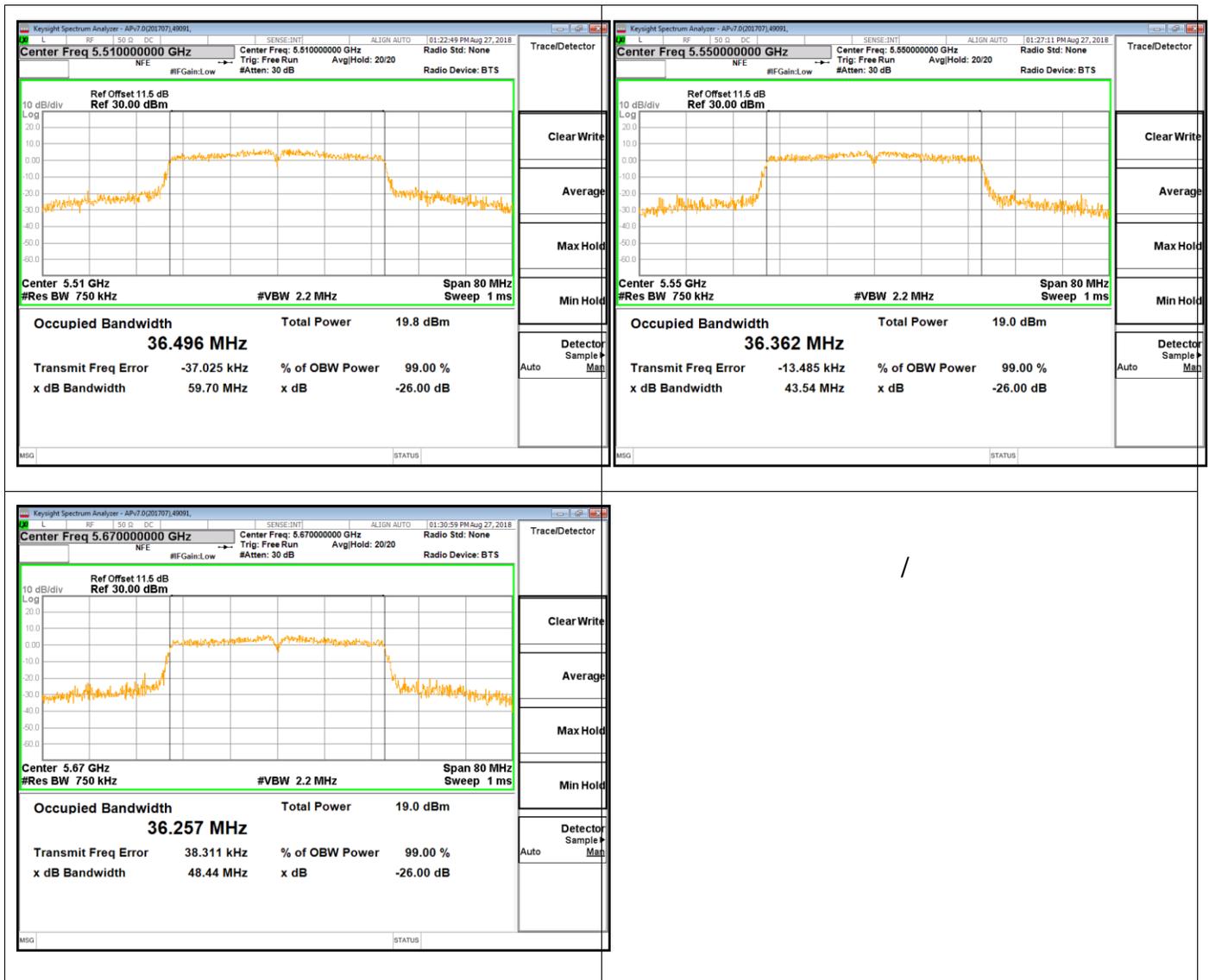
Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5270	50.59	36.344
High	5310	45.25	36.402





6.2.3.3. UNII-2C BAND

Channel	Frequency (MHz)	26 dB BW (MHz)	99% BW (MHz)
Low	5510	59.70	36.496
Mid	5550	43.54	36.362
High	5670	48.44	36.257





6.2.3.4. UNII-3 BAND

Channel	Frequency (MHz)	6 dB BW (MHz)	Limit (KHz)	Result
Low	5755	35.40	500	PASS
High	5795	35.50	500	PASS

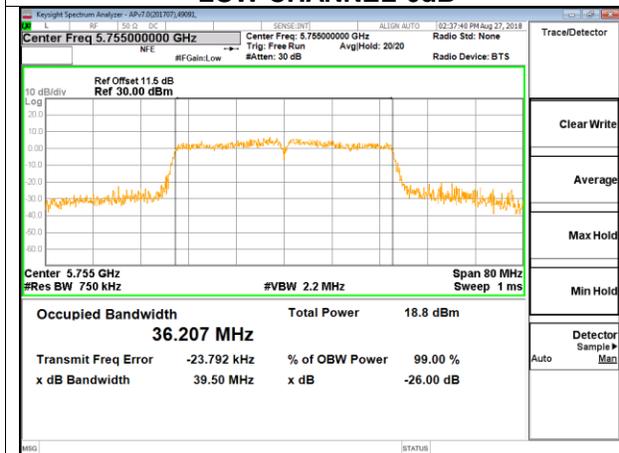
Channel	Frequency (MHz)	99% BW (MHz)
Low	5755	36.207
High	5795	36.376



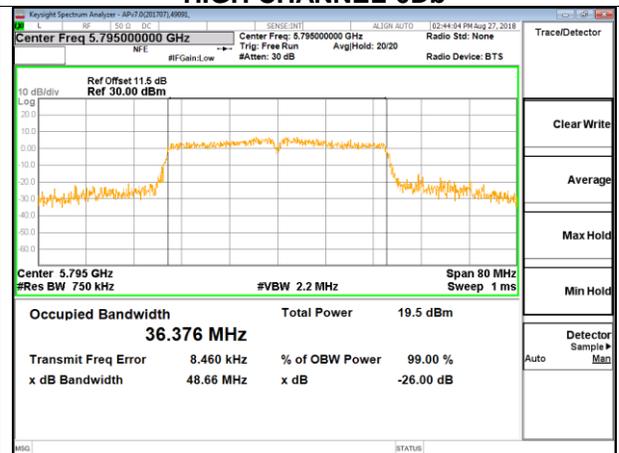
LOW CHANNEL-6dB



HIGH CHANNEL-6dB



LOW CHANNEL-99%



HIGH CHANNEL-99%

6.3. MAXIMUM CONDUCTED AV OUTPUT POWER

LIMITS

FCC Part15, Subpart E/ RSS-247		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	For FCC client devices :250mW (24dBm)	5150-5250
	For RSS:e.i.r.p. power: not exceed 200 mW(23dBm) or $10 + 10 \log_{10} B$	
	250mW (24dBm)	5250-5350
	250mW (24dBm)	For FCC:5470-5725 For IC:5470-5600 5650-5725
	1 Watt (30dBm)	5725-5850

Note: If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

TEST PROCEDURE

Refer to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Measurement using an RF average power meter.

Connect the EUT to the a broadband average RF power meter, the power meter shall have a video bandwidth that is greater than or equal to the bandwidth and shall utilize a fast-responding diode detector.

TEST SETUP





RESULTS

Mode	Channel	Conducted AV Power (dBm)	Limit
802.11a	5180	15.69	24
	5200	15.45	24
	5240	15.61	24
	5260	15.39	24
	5300	15.76	24
	5320	15.38	24
	5500	15.71	24
	5580	15.52	24
	5700	15.79	24
	5745	15.51	30
	5785	15.36	30
	5825	15.81	30
802.11n HT20	5180	15.31	24
	5200	15.11	24
	5240	15.22	24
	5260	14.91	24
	5300	15.38	24
	5320	15.11	24
	5500	14.82	24
	5580	14.92	24
	5700	15.29	24
	5745	14.91	30
	5785	15.07	30
	5825	14.71	30
802.11n HT40	5190	14.01	24
	5230	14.02	24
	5270	14.04	24
	5310	14.32	24
	5510	14.12	24
	5590	14.01	24
	5670	13.78	30
	5755	13.76	30
	5795	14.16	30

Note: The test result has taking into account the duty factor.